5. TRIBUTARY HABITAT CONDITIONS

5.1 OVERVIEW

The core team assessed tributary habitat conditions upstream of the storage reservoirs. The team also considered the potential for improving connectivity among populations of native fish. The team obtained tributary stream length in miles up to natural or man-made barriers from various published reports and USFS stream surveys. The team estimated, where possible, the additional length of tributary stream that might be available if man-made barriers to fish passage, such as improperly placed culverts or other obstructions, were replaced and/or improved to allow fish passage.

The team attempted a qualitative evaluation of the spawning and rearing habitat in the tributary streams based on information on numerous environmental variables such as stream gradient, reported assessments of the quality of spawning conditions, available information on water temperature, habitat conditions including large woody debris, and pool frequency and quality. The data were collected from various agency reports and peer reviewed papers; the team also considered on-the-ground observations and experiences of the team participants. The data are discussed in greater detail in Appendix B to this Phase I assessment report. Information relating to spawning and rearing habitat for anadromous salmonids was not uniform for all tributary streams, so quantitative comparison among tributary streams was not possible.

The team did not attempt to calculate potential increases or changes in anadromous salmonid production as a result of habitat expansion upstream from reservoirs. This would have required more time and information than was available. Therefore, miles of available and potentially accessible reservoir tributary habitat was used as a surrogate for production in this Phase I assessment. It must be emphasized that environmental conditions in the Columbia River migration corridor, the estuary and the ocean will also affect the population response of anadromous salmonids in the Yakima River basin, and any population response would not likely be apparent for at least several generations, so long-term observations and monitoring would be required.

For this preliminary assessment, the team assumed that on a scale of from excellent to poor, the newly accessible habitat would be "good" overall for successful spawning and rearing in all subbasins. The team assumed the "good" habitat rating since the reported quality of the habitat in some reaches was "excellent" (with parameters that met Forest Plan standards) while other reaches of the same tributary had poorer quality habitat (and did not meet Forest Plan standards). The team felt that habitat conditions overall were about average and assigned the "good" rating. This outcome was based on information from the environmental factors matrices compiled by the fisheries subteam and on Habitat Condition Rating information extracted from Table 39 of *Habitat Limiting Factors*

(WSCC 2001). The team did not have sufficient data to distinguish on a fine scale the habitat quality differences among the different reservoir tributaries.

The fisheries subteam used existing data and information to assess tributary habitat. In this process the subteam noted that different reports sometimes reported different values for the same parameter. This was particularly problematic regarding stream length and habitat condition. Inconsistent inventory data for the same stream reach surveyed in different years is straightforward to understand and explain, since environmental conditions prevailing at the time or season the survey was conducted could influence the value of a parameter, as could intervening natural or man-caused activities such as mass wasting events or fire, or a timber harvest operation. This dilemma required using professional judgment in some cases to resolve the problem of conflicting information. An example of this situation is stream length reported for the Cle Elum River and some of its tributaries.

Estimated overall reservoir tributary stream length in miles of suitable spawning and rearing habitat that would be potentially accessible to anadromous salmonids if passage were provided at the several dams is shown in Table 5-1, and in the case of Keechelus Dam, tributary stream length available if man-made fish passage barriers such as culverts were replaced, improved, or both.

Table 5-1. Combined tributary stream length potentially accessible to anadromous salmonids upstream from five Yakima River basin storage dams if fish passage were provided

Dam	**Stream length to natural or man-made barrier** (miles)	**Stream length available if man-made barriers removed** (miles)
Keechelus Dam	13.8	16.8
Kachess Dam	2.4	TBD
Cle Elum Dam	29.4	TBD
Bumping Lake Dam	6.0	TBD
Tieton Dam	36.8	TBD

- TBD = to be determined

In the following section, we provide additional detail on individual tributaries to the five reservoirs, and discuss quantity and quality of potentially accessible tributary habitat that would likely be available to anadromous salmonids if upstream and downstream passage were provided at the dams.

5.2 TRIBUTARY HABITAT CONDITIONS BY RESERVOIR

5.2.1 Keechelus Lake — Tributaries considered include Coal, Gold, Cold, Meadow, Mill, Townsend, and Roaring creeks.

Although bull trout and anadromous salmonids may have used numerous tributary streams prior to the construction of Keechelus Dam, the only tributary to Keechelus Lake documented to have

historically supported anadromous salmonids (spring chinook salmon, coho salmon, and summer steelhead) and bull trout is Gold Creek (Haring 2001), which now supports a recognized subpopulation of bull trout. There is historical evidence of presence of bull trout in Rocky Run Creek (WDFW 1983) and it is likely that populations existed historically in Meadow Creek and Coal Creek. At least three tributaries to Keechelus Lake (Meadow, Cold, and Coal creeks) have potential to be restored to support anadromous salmonids and/or bull trout; surveys circa 1994 by Central Washington University students found only cutthroat trout in these streams (Brent Renfrow, WDFW, pers. comm.).

Anadromous salmonids may have historically used the smaller tributaries (Mill, Resort, Roaring Creeks, etc.), but data are lacking. Roaring, Resort and Rocky Run Creeks are thought to be too small or steep for anadromous salmonids. The best habitat in the smaller creeks would have been in the downstream area now inundated by the reservoir (reservoir drawdown photos indicate presence of likely suitable lower gradient habitat for anadromous salmonid juveniles, and even adults when adequate flow is present).

Table 5-2 lists miles of tributary streams to Keechelus Lake potentially accessible if passage was provided at the dam, along with miles of stream potentially available upstream to natural barriers (falls, steep gradient, etc.) if man-made barriers (such as culverts) were removed.

Table 5-2. Tributary streams to Keechelus Lake with habitat considered suitable for migratory salmonids

Tributary Stream	**Potentially accessible** [miles (km)]	**Potentially accessible if man-made barriers removed** [miles (km)]	**Comments**
Meadow Creek	3.9 (6.5)	3.9 (6.5)	Waterfall limits upstream migration (USFS 1995)
Gold Creek	7.0 (11.5)	7.0 (11.5)	Primary spawning stream for Keechelus; waterfall limits upstream migration (Craig 1997)
Cold Creek	0.0	1.9 (3.2)	Railroad culvert blocks access (USFS 1992)
Mill Creek	0.2 (0.32)	1.0 (1.6)	Railroad culvert blocks access, habitat surveys may be needed
Coal Creek	2.5 (4.2)	2.5 (4.2)	I-90 culverts and stream channelization limit access
Townsend Creek	0.2 (0.32)	0.5 (0.8)	I-90 culverts limit access
Total	***13.8 (22.2)***	***16.8 (27.0)***	
• Other tributaries to Keechelus Lake were considered too small or steep to support migratory fish.			

If passage were provided at Keechelus Dam, Gold Creek and Meadow Creek would be the most likely tributary habitats potentially accessible and suitable for anadromous salmonids, providing about 10.9 miles of accessible habitat. Habitat quality in the several tributaries varies, due to substrate composition, water temperatures, or riparian or stream channel conditions that do not meet "Forest Plan" standards (USFS 1994), or passage barriers relatively close to the mouth.

In addition, passage may be impeded at times in these creeks due to low streamflow conditions. Such is the case in Gold Creek which frequently contains a dewatered reach one-to-two kilometers in length during the late summer and early fall. The length of time this condition persists is variable with sporadic reconnection occurring as a result of rainfall events and full time reconnection usually occurring by early October.

5.2.2 Kachess Lake — Nearly all the Kachess River watershed is presently inaccessible to anadromous salmonids, due to presence of Kachess Dam at RM 1. Historically, the natural lake had anadromous runs of sockeye, coho and spring chinook salmon, and steelhead. Resident fishes, including bull trout, would have had year-round access into the lake.

Table 5-3 lists the stream habitat that would be accessible to anadromous salmonids if passage were provided at Kachess Lake.

Table 5-3. Tributary streams to Kachess Lake, with habitat considered suitable for anadromous salmonids

Tributary Stream	Potentially accessible [miles (km)]	Potentially accessible if man-made barriers removed [miles (km)]	Comments
Kachess River	0.5 (0.8)	0	Primary spawning stream
Box Canyon Creek	1.6 (2.57)	0	Primary spawning stream; natural barrier falls
Mineral Creek	0.25 (0.40)	0	Series of cascades blocks fish passage
Gale Creek*	1.5 (2.4)	0	Barrier falls in third reach (about 1.5 miles upstream); in late summer, stream commonly goes subsurface in the lake bed and upstream
Thetis Creek*	1.0 (1.6) based on map		In late summer, stream commonly goes subsurface in the lake bed and upstream
Total	**2.35 (3.76)**		

* Since Gale Creek and Thetis Creek commonly go subsurface, they are not considered as being accessible to anadromous salmonids, and the overall tributary stream length is 2.35 miles.

• Other tributaries to Kachess Lake were considered too small or steep to support migratory fish.

If passage were provided for anadromous salmonids at Kachess Dam, about 2.35 miles of tributary habitat would be accessible upstream from the lake. Habitat quality in the several tributaries varies, due to difference in substrate composition, water temperatures, or riparian or stream channel conditions that do not meet USFS Forest Plan standards. Depending on precipitation, the Kachess River is usually but not always dry near its confluence with Kachess Reservoir in late summer through late October, which may impact bull trout movement into the river. Other species (coho salmon and spring chinook salmon) would likely also be impacted by this occasional and temporary dewatering.

5.2.3 Cle Elum Lake — Cle Elum Lake is the largest of the four reservoirs in the Yakima River basin that once supported runs of anadromous salmonids. Historically, sockeye salmon used

the lake for rearing and, along with coho and spring chinook salmon, the streams above the lake for spawning (Robison 1957, Mongillo and Faulconer 1982, both as cited in Flagg and Ruehle 2000). Resident fishes including bull trout would have had year-round access into the lake.

The lake has a large and diverse watershed with numerous tributaries, three of which (the Cle Elum, Cooper, and Waptus Rivers) contain a large amount of potential spawning habitat for anadromous salmonids and bull trout (Spotts 1981, cited in Slatick and Park 2000; Thomas, FWS, 2003, pers. comm.). A series of steep cascades on the Cle Elum River (about RM 9) is a potential upstream barrier to fish passage, but it may be passable under certain flow conditions. The Cooper River has a barrier approximately 0.6 mile (1 km) upstream from Salmon La Sac, while Waptus Falls at about RM 7.2 in the Alpine Lakes Wilderness Area is a barrier on the Waptus River.

Table 5-4 lists the stream habitat that would be potentially accessible to anadromous salmonids if passage were provided at Cle Elum Lake.

Table 5-4. Tributary streams to Cle Elum Lake with habitat considered suitable for migratory salmonids

Tributary Stream	**Potentially accessible** [miles (km)]	**Potentially accessible if man-made barriers removed** [miles (km)]	**Comments**
Cle Elum River	21.6 (34.6)		Steep cascades at RM 9 may impede upstream fish migration
Thorp Creek	0		Barrier cascades and high gradient in lower reach
Cooper River	0.6 (1)		Barrier falls
Waptus River	7.2 (11.5)		Impassable falls
Total	**29.4 (47.0)**		

- Other tributaries to Cle Elum Lake were considered too small or steep to support migratory fish.

The combined length of tributary streams potentially available upstream from Cle Elum Dam if fish passage were provided was complicated by the fact that the several reports available provided different estimates of the habitat potentially available in the Cle Elum River. For example, Flagg et al. (2000) reported that "Cle Elum Falls" (considered by local fisheries biologists as a series of cascades), about 9 miles upstream from the full pool end of the reservoir, would block adult fish migration under most water flow conditions. However, Haring (2001) stated that migratory fish would have access to 18.4 miles of Cle Elum River habitat up to Hyas Lake, and Croci (FWS, Yakima, WA, pers. comm., 2002) reported Cle Elum River length as 21.6 miles. Since adult anadromous salmonids are generally strong swimmers, it is reasonable to expect that some fish would be able to negotiate the cascades at RM 9 and access the river upstream, based on the description of this area as a series of small falls with a maximum height of about 3 m (≈10 feet).

If passage were provided for anadromous salmonids at Cle Elum Dam, about 29.4 miles of tributary habitat would be accessible upstream from Cle Elum Lake. Habitat quality in the several

tributaries varies, due in some cases to substrate composition, water temperatures, or riparian or stream channel conditions that do not meet USFS Forest Plan standards.

5.2.4 Bumping Lake — Table 5-5 lists the stream habitat that would be accessible to anadromous salmonids if passage were provided at Bumping Lake.

Table 5-5. Tributary streams to Bumping Lake with habitat considered suitable for migratory salmonids

Tributary Stream	Potentially accessible [miles (km)]	Potentially accessible if man-made barriers removed [miles (km)]	Comments
Bumping River	1.0 (1.6)		Waterfall limits upstream migration (USFS 1995)
Deep Creek	5-5.6 (8-9)		Upper 0.5 miles goes subsurface in low water years
Total	**6-6.6 (9-10.6)**		

- Other tributaries to Bumping Lake were considered too small or steep to support migratory fish..

If passage were provided for anadromous salmonids at Bumping Lake Dam, about 6 miles of tributary habitat would be accessible upstream from Bumping Lake. Habitat quality in the several tributaries varies, due to differences in substrate composition, water temperatures, or riparian or stream channel conditions that do not meet USFS Forest Plan standards.

5.2.5 Rimrock Lake — Table 5-6 lists the stream habitat that would be accessible to anadromous salmonids if passage were provided at Rimrock Lake.

Table 5-6. Tributary streams to Rimrock Lake with habitat considered suitable for migratory salmonids

Tributary Stream	Potentially accessible [miles (km)]	Potentially accessible if man-made barriers removed [miles (km)]	Comments
South Fork Tieton River	13.5 (21.6)		Falls at 13.5 mi. limits upstream migration
Short and Dirty Creek	0.1 (0.16)	0	Natural barrier limits upstream migration
Corral Creek	2.2 (3.5)		Falls at 2.2 mi. limits upstream migration
Bear Creek (SF Tieton)	0.5 (0.8)		Natural barrier limits upstream migration
Bear Creek (Rimrock)	3.7 (5.9)	0	High sedimentation
NF Tieton River	9.9 (15.9)		Falls at 9.9 mi. limit upstream migration
Clear Creek	2.0 (3.2)		Barrier falls limit upstream migration
Indian Creek	4.9 (7.8)	0	Falls at 4.9 miles limit upstream migration
Total	**36.8 (59)**		

- Other tributaries to Rimrock Lake were considered too small or steep to support migratory fish.